

WHAT IS CLAIMED IS:

1. A fluid ejector, comprising:  
a thermally-conductive fluid ejector carriage;  
a structure upon which the thermally-conductive carriage translates;  
and  
at least one thermally-conductive interface structure between the thermally-conductive fluid ejector carriage and the structure upon which the thermally-conductive carriage translates that provides a heat flow path from the thermally-conductive fluid ejector carriage into the at least one thermally-conductive interface structure.
2. The fluid ejector of claim 1, wherein the at least one thermally-conductive interface structure is a carriage rod guide with substantially a hollow tube-like structure.
3. The fluid ejector of claim 1, wherein the at least one thermally-conductive interface structure comprises at least one thermally-conductive material.
4. The fluid ejector of claim 3, wherein at least one thermally-conductive material includes at least one polymer.
5. The fluid ejector of claim 4, wherein at least one polymer is at least one of liquid crystal polymer, polyphenylene sulfide and polysulfone.
6. The fluid ejector of claim 4, wherein at least one polymer is chemically resistant to ink.
7. The fluid ejector of claim 3, wherein at least one thermally-conductive material includes a polymer material and at least one thermally-conductive filler material.
8. The fluid ejector of claim 7, wherein at least one of the at least one thermally-conductive filler material has a thermal conductivity greater than about 10 W/m°C.
9. The fluid ejector of claim 7, wherein at least one of the at least one thermally-conductive filler material has a thermal conductivity less than about 100 W/m°C.
10. The fluid ejector of claim 9, wherein at least one of the at least one thermally-conductive filler material has a thermal conductivity of greater than 10 W/m°C.

11. The fluid ejector of claim 7, wherein at least one of the at least one thermally-conductive filler material includes a graphite material.
12. The fluid ejector of claim 11, wherein the graphite material is formed using a petroleum pitch base material.
13. The fluid ejector of claim 7, wherein at least one of the at least one thermally-conductive filler material is a ceramic material.
14. The fluid ejector of claim 13, wherein the ceramic material is at least one of boron nitride and aluminum nitride.
15. The fluid ejector of claim 1, wherein the structure upon which the thermally-conductive carriage translates is at least one thermally-conductive carriage guide rod, where the at least one thermally-conductive interface structure translates along the at least one thermally-conductive carriage guide rod.
16. The fluid ejector of claim 15, wherein the at least one thermally-conductive carriage guide rod comprises at least one thermally-conductive material.
17. The fluid ejector of claim 16, wherein at least one thermally-conductive material includes at least one polymer.
18. The fluid ejector of claim 17, wherein at least one polymer is at least one of liquid crystal polymer, polyphenylene sulfide and polysulfone.
19. The fluid ejector of claim 17, wherein at least one polymer is chemically resistant to ink.
20. The fluid ejector of claim 16, wherein at least one thermally-conductive material includes a polymer material and at least one thermally-conductive filler material.
21. The fluid ejector of claim 20, wherein at least one of the at least one thermally-conductive filler material has a thermal conductivity greater than about 10 W/m°C.
22. The fluid ejector of claim 20, wherein at least one of the at least one thermally-conductive filler material has a thermal conductivity less than about 100 W/m°C.
23. The fluid ejector of claim 22, wherein at least one of the at least one thermally-conductive filler material has a thermal conductivity of greater than 10 W/m°C.

24. The fluid ejector of claim 20, wherein at least one of the at least one thermally-conductive filler material includes a graphite material.

25. The fluid ejector of claim 24, wherein the graphite material is formed using a petroleum pitch base material.

26. The fluid ejector of claim 20, wherein at least one of the at least one thermally-conductive filler material is a ceramic material.

27. The fluid ejector of claim 26, wherein the ceramic material is at least one of boron nitride and aluminum nitride.

28. The fluid ejector of claim 15, wherein the at least one thermally-conductive interface structure that translates along the at least one thermally-conductive carriage guide rod is a hollow tube-like rod guide structure that has a generally corresponding cross-sectional shape and a slightly larger cross-sectional area than that of the at least one thermally-conductive carriage guide rod, such that a thin film of air is present between the surface of the at least one thermally-conductive carriage guide rod and an internal surface of the at least one thermally-conductive tube-like carriage rod guide.

29. The fluid ejector of claim 28, further comprising at least one thermally-conductive rod guide bearing that encloses at least one open end of the at least one thermally-conductive carriage rod guide.

30. The fluid ejector of claim 29, wherein the at least one thermally-conductive rod guide bearing has an opening having a generally corresponding cross-sectional shape and a generally corresponding cross-sectional area as that of the at least one thermally-conductive carriage guide rod, such that the at least one thermally-conductive carriage rod guide bearing and the at least one thermally-conductive carriage guide rod provide a heat flow path to conduct heat from the thermally-conductive fluid ejector carriage and the at least one thermally-conductive carriage rod guide into the at least one thermally-conductive carriage guide rod.

31. The fluid ejector of claim 30, wherein motion of the fluid ejector carriage and the at least one thermally-conductive carriage rod guide, as the at least one thermally-conductive carriage rod guide translates along the at least one thermally-conductive carriage guide rod, is not impeded by contact between the at least one thermally-conductive carriage rod guide bearing and the at least one thermally-conductive carriage guide rod.

32. The fluid ejector of claim 29, wherein the at least one thermally-conductive carriage rod guide bearing traps a thin volume of air bounded by an internal surface of the at least one thermally-conductive carriage rod guide, the surface of the at least one thermally-conductive carriage guide rod and the at least one thermally-conductive carriage guide rod bearing.

33. The fluid ejector of claim 32, wherein heat is dissipated through convection through the thin volume of air as the thin volume of air is sheared across the surface of the at least one thermally-conductive carriage guide rod as the fluid ejector carriage and the at least one thermally-conductive carriage rod guide translate along the at least one thermally-conductive carriage guide rod.

34. The fluid ejector of claim 30, further comprising at least one compliant, thermally-conductive pad that is usable to augment contact between the at least one thermally-conductive carriage rod guide bearing and the at least one thermally-conductive carriage guide rod.

35. The fluid ejector of claim 30, further comprising at least one phase change or other thermally-conductive heat sink compound that is usable to augment contact between the at least one thermally-conductive carriage rod guide bearing and the at least one thermally-conductive carriage guide rod.

36. The fluid ejector of claim 30, further comprising at least one mechanical device or structure usable to conduct heat that is usable to augment contact between the at least one thermally-conductive carriage rod guide bearing and the at least one thermally-conductive carriage guide rod.

37. A method of manufacturing a fluid ejector, comprising:  
providing at least one thermally-conductive carriage guide rod;  
providing at least one thermally-conductive carriage rod guide;  
providing at least one thermally-conductive carriage rod guide bearing;  
placing the at least one thermally-conductive carriage rod guide on the at least one thermally-conductive carriage guide rod; and

placing at least one thermally-conductive carriage rod guide bearing on at least one end of the at least one thermally-conductive carriage rod guide such that at least one thermally-conductive bearing provides a surface-to-surface heat flow path between the at least one thermally-conductive carriage rod guide and the at least one thermally-conductive carriage guide rod.

38. The method of claim 37, further comprising enclosing a thin layer of air between an internal surface of the at least one thermally-conductive carriage rod guide and the surface of the at least one thermally-conductive carriage guide rod as a thin volume of trapped air using at least one thermally-conductive bearing on at least one end of the at least one thermally-conductive carriage rod guide.

39. The method of claim 37, wherein providing the at least one thermally-conductive carriage guide rod comprises manufacturing the at least one thermally-conductive carriage guide rod from at least one thermally-conductive polymer material.

40. The method of claim 37, wherein providing the at least one thermally-conductive carriage rod guide comprises manufacturing the at least one thermally-conductive carriage rod guide from at least one thermally-conductive polymer material..

41. The method of claim 37, wherein providing the at least one thermally-conductive carriage rod guide bearing comprises manufacturing the at least one thermally-conductive carriage rod guide bearing from at least one thermally-conductive polymer material.

42. The method of claim 37, wherein providing the at least one thermally-conductive carriage rod guide bearing comprises manufacturing the at least one thermally-conductive carriage rod guide bearing integrally with the at least one thermally-conductive carriage rod guide as a single structure.

43. A method for dissipating heat from a fluid ejector module, comprising:  
operating at least one fluid ejector module to generate heat in the fluid ejector module;

transferring the heat from the fluid ejector module to a thermally-conductive fluid ejector carriage device with which the fluid ejector module is in thermal contact;

transferring heat from the thermally-conductive fluid ejector carriage device to at least one thermally-conductive interface structure between the fluid ejector carriage device and a structure upon which the fluid ejector carriage device translates; and

transferring heat from the at least one thermally-conductive interface structure to ambient air based on the thermal contact between the surface of the at least one thermally-conductive interface structure and the surrounding ambient air.

44. The method of claim 43, further comprising:

transferring heat from the at least one thermally-conductive interface structure to at least one thermally-conductive structure upon which the fluid ejector carriage device translates; and

transferring heat from the at least one thermally-conductive interface structure to ambient air based on the thermal contact between the surface of the at least one thermally-conductive structure upon which the fluid ejector carriage device translates and the surrounding ambient air.

45. The method of claim 43, wherein transferring heat from the at least one thermally-conductive interface structure to the at least one thermally-conductive structure upon which the fluid ejector carriage device translates comprises:

transferring heat from at least one thermally-conductive carriage rod guide to at least one thermally-conductive carriage rod guide bearing; and

transferring heat from the at least one thermally-conductive carriage rod guide bearing to the at least one thermally-conductive carriage guide rod through surface-to-surface contact between the at least one thermally-conductive carriage rod guide bearing to the at least one thermally-conductive carriage guide rod.

46. The method of claim 44, wherein transferring heat through the surface-to-surface contact between the at least one thermally-conductive carriage rod guide bearing to the at least one thermally-conductive carriage guide rod comprises transferring heat through a compliant, thermally-conductive pad located between the at least one thermally-conductive carriage rod guide bearing to the at least one thermally-conductive carriage guide rod.

47. The method of claim 44, wherein transferring heat through the surface-to-surface contact between the at least one thermally-conductive carriage rod guide bearing to the at least one thermally-conductive carriage guide rod comprises transferring heat through a phase change or other thermally-conductive heat sink compound located between the at least one thermally-conductive carriage rod guide bearing to the at least one thermally-conductive carriage guide rod.

48. The method of claim 43, wherein transferring heat from the at least one thermally-conductive interface structure to the at least one thermally-conductive structure upon which the fluid ejector carriage translates further comprises:

transferring heat from the internal surface of at least one thermally-conductive carriage rod guide to a thin volume of air trapped between at least an internal surface of at least one thermally-conductive carriage rod guide, and a surface of the at least one thermally-conductive carriage guide rod; and

transferring heat from the thin volume of trapped air to the at least one thermally-conductive carriage guide rod.

49. The method of claim 48, further comprising inducing a complex air flow pattern in the thin volume of air trapped between at least an internal surface of the at least one thermally-conductive carriage rod guide and a surface of the at least one thermally-conductive carriage guide rod as the at least one the thermally-conductive carriage rod guide translates along the at least one thermally-conductive carriage guide rod.

50. The method of claim 48, further comprising shearing the thin volume of air trapped between at least an internal surface of the at least one thermally-conductive carriage rod guide and a surface of the at least one thermally-conductive carriage guide rod across the surface of the at least one thermally-conductive carriage guide rod as the at least one thermally-conductive carriage rod guide translates along the at least one thermally-conductive carriage guide rod.

51. The method of claim 43, wherein transferring heat from the from the thermally-conductive fluid ejector carriage device and the at least one thermally-conductive interface structure to the surrounding ambient air comprises transferring heat from the from the thermally-conductive fluid ejector carriage device and the at least one thermally-conductive interface structure to the surrounding ambient air via a fanning motion of the thermally-conductive fluid ejector carriage device and the at least one thermally-conductive interface structure as the at least one thermally-conductive interface structure translates along at least one thermally-conductive structure upon which the thermally-conductive fluid ejector carriage device and thermally-conductive interface structure translate.